

# PATENT SPECIFICATION



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257,111

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Complete Accepted: Aug. 26, 1926.

## PROVISIONAL SPECIFICATION.

### Improvements in or relating to Centrifugal Pumps.

We, HATHORN, DAVEY AND COMPANY, LIMITED, a company organised under the laws of Great Britain, and HUGH RALPH LUPTON, a British subject, both of Sun Foundry, Dewsbury Road, Leeds, in the County of York, do hereby declare the nature of this invention to be as follows:—

This invention relates to low lift centrifugal pumps, the chief object being to construct a pump which for a given duty shall be smaller, more compact and capable of being placed in a smaller suction well than the ordinary centrifugal pump.  
According to the invention, the impeller is so constructed as to cause the flow at the exit therefrom to have an axial component in addition to the usual tangential and radial components. In an embodiment of the invention, the shape or contour and inclination of the impeller vanes together with the angular disposition of the guide blades thereto

are such as to cause axial as well as tangential and radial motion to be imparted to the liquid, while at the same time ensuring high efficiency over a wide range of variation in head without over-loading of the driving agent in the event of the head against which the pump delivers being diminished. The water passages are made large with a view to rendering the pump practically unchockable; while further the driving speed may be higher than that of ordinary centrifugal pumps and thereby enable a cheaper driving agent or motor to be employed.

Dated this 24th day of September, 1925.

HATHORN, DAVEY AND COMPANY, LIMITED,

HUGH RALPH LUPTON,

Per John E. Walsh & Co.,  
7, East Parade, Leeds, and at Halifax,  
Agents for Applicants.

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## COMPLETE SPECIFICATION.

### Improvements in or relating to Centrifugal Pumps.

We, HATHORN, DAVEY AND COMPANY, LIMITED, a company organised under the laws of Great Britain, and HUGH RALPH LUPTON, a British subject, both of Sun Foundry, Dewsbury Road, Leeds, in the County of York, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to low lift pumps of the kind provided with impellers of varying angles mounted upon a central driving shaft and having guiding elements carried upon or supported from a

tubular element or shaft arranged concentrically with the driving shaft, the chief object being to construct a pump which for a given duty shall be smaller, more compact and capable of being placed in a smaller suction well than the ordinary centrifugal pump.

According to the invention the pump is adapted to work on a combination of the centrifugal and screw principles, the impeller being so constructed as to cause the flow at the exit therefrom to have an axial component approximately equal to the radial component in addition to the tangential and radial components usual

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[Price 1/-]

in centrifugal pumps, and angularly disposed guide vanes designed efficiently to convert this axial as well as the other above-mentioned components of the velocity into pressure.

In order that the invention may be clearly understood and readily carried into effect, the same will now be more fully described with reference to the embodiment illustrated in the accompanying drawings, wherein:—

Figure 1 is a vertical section of a centrifugal pump of the vertical type constructed according to the invention.

Figures 2 and 3 are respectively a vertical section and a plan of a half of the pump impeller, drawn to an enlarged scale.

Figure 4 is a development of one of the impeller vanes on the mid-stream line A. B. of Figure 3.

Figure 5 is a development of the impeller vanes showing the contour thereof round the impeller hub.

Figure 6 is a development of the impeller vane showing the contour thereof round the rim.

Figure 7 is a half sectional plan taken on the lines C. D. of Figure 1, and drawn to an enlarged scale.

Figure 8 is a section of one of the guide blades at the hub portion.

Figure 9 is a section of the guide blade at the rim portion.

Referring to Figure 1 of the drawings, the centrifugal pump comprises a three-part casing, the lower portion 1 of which constitutes the flared inlet to the impeller, which covers the whole inlet area, the centre portion 2, the guide vane casing, and the upper portion 3 the delivery chamber and outlet. The vertical driving shaft 4 is rotatably mounted in bearings 5, the lower one of which is carried by the boss 6 of the guide blades 7, and the upper end of said shaft 4 is provided with a keyed-on coupling disc 8, while the lower end of said shaft 4 has keyed thereto the boss 9 of the impeller vanes 10. The impeller vanes 10, of which in this embodiment there are three around the boss 9, taper upwardly and outwardly into the guide blade casing 2, and said impeller vanes 10 are inclined to the vertical axis as illustrated in the development views at Figures 4, 5 and 6 wherein the vertical section lines *a*, *b*, *c*, *d*, *e*, *f*, *g* and *h* correspond to the radial section lines correspondingly referenced in Figure 3, and in which the vertical heights between the horizontals in said figures represent the true lengths measured along the mid-stream dividing surface trace A. B. (Figure 3), section

along surface of hub (Figure 2) and along rim (Figure 2).

The blades 10 are so designed that there is no pressure difference across a conical, or rather fusée shaped, dividing surface between the stream line layers such as shown in the section A. B. at Figure 2.

The impeller vanes 10 terminate on a conical surface which is perpendicular to the direction of the through flow of the water, such surface being approximately 45° to the axis of the pump, while throughout the impeller the cross-section at right angles to the through flow is not divergent.

The guide blades 7, of which in this embodiment there are four around the boss 6, are radially arranged and taper downwardly, while the curvature of the tips 7<sup>1</sup> of said blades 7 are struck from a less radius adjacent the boss 6 than at the rim (see Figures 7, 8 and 9).

The shape and contour and inclination of the impeller vanes 10 together with the angular disposition of the guide blades 7 thereto as above described and shown are such as to cause axial as well as tangential and radial motion to be imparted to the liquid, while at the same time ensuring high efficiency over a wide range of variation in head without overloading of the driving agent in the event of the head against which the pump delivers being diminished. The water passages are made large with a view to rendering the pump practically unchokeable; while further, the driving speed may be higher than that of ordinary centrifugal pumps and thereby enable a cheaper driving agent or motor to be employed.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Low lift pumps, adapted to work on a combination of the centrifugal and screw principles, wherein the impeller is so constructed as to cause the flow at the exit therefrom to have an axial component approximately equal to the radial component in addition to the tangential and radial components usual in centrifugal pumps, and wherein angularly disposed guide vanes are designed efficiently to convert this axial, as well as the other above-mentioned components of the velocity, into pressure.

2. Low lift pumps according to Claim 1, wherein the shape or contour and inclination of the impeller vanes together with the angular disposition of the guide

blades thereto are such as to cause axial as well as tangential and radial motion to be imparted to the liquid, while at the same time ensuring high efficiency over a wide range or variation in head without overloading of the driving agent.

5 3. Low lift pumps according to Claims 1 and 2, constructed, arranged and adapted to operate substantially as

hereinbefore described with reference to 16 the accompanying drawings.

Dated this 25th day of June, 1926.  
HATHORN, DAVEY AND COMPANY,

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257,111 COMPLETE SPECIFICATION

SHEET 1

SHEET 2

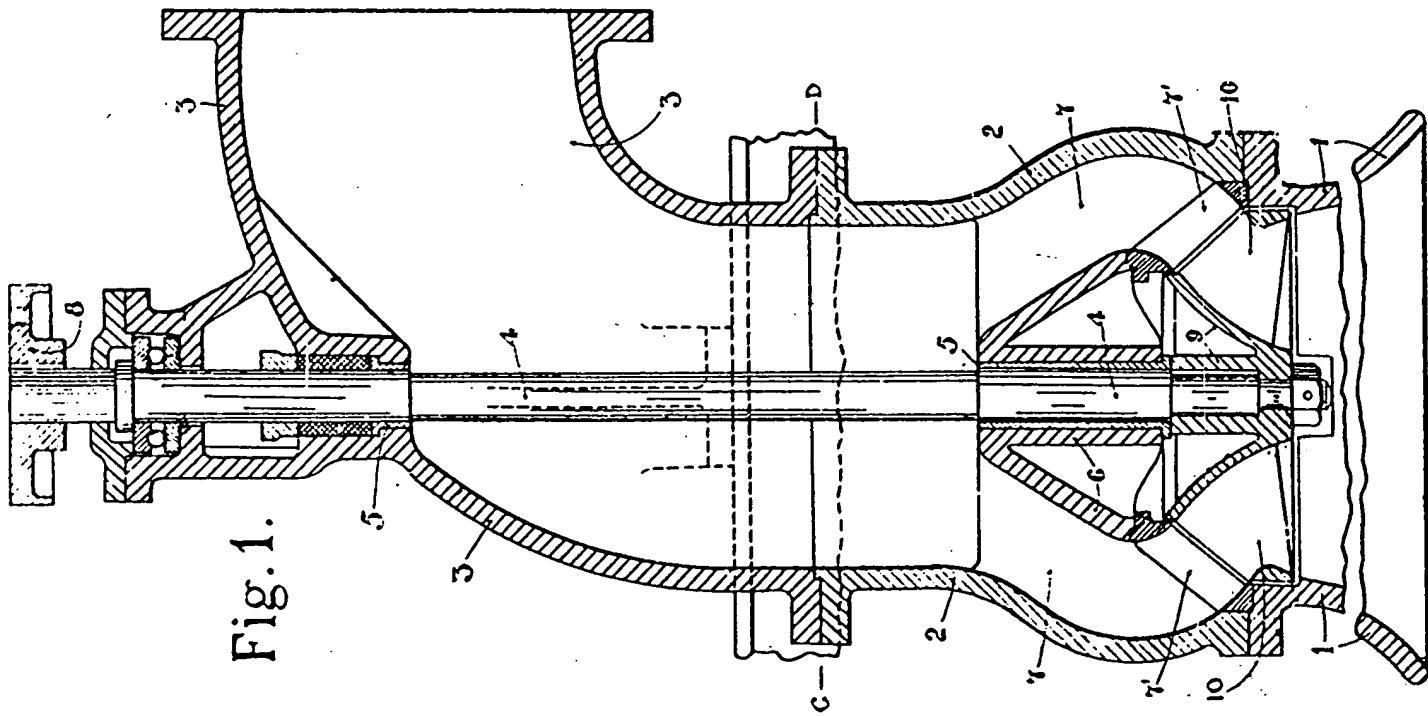


Fig. 2.

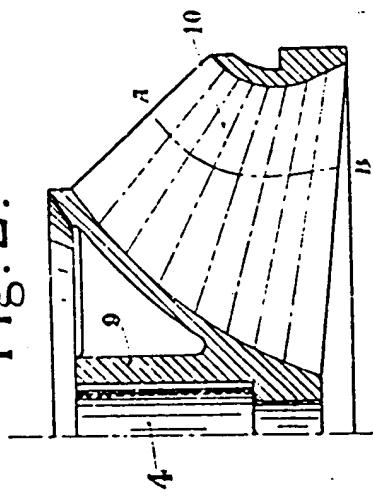
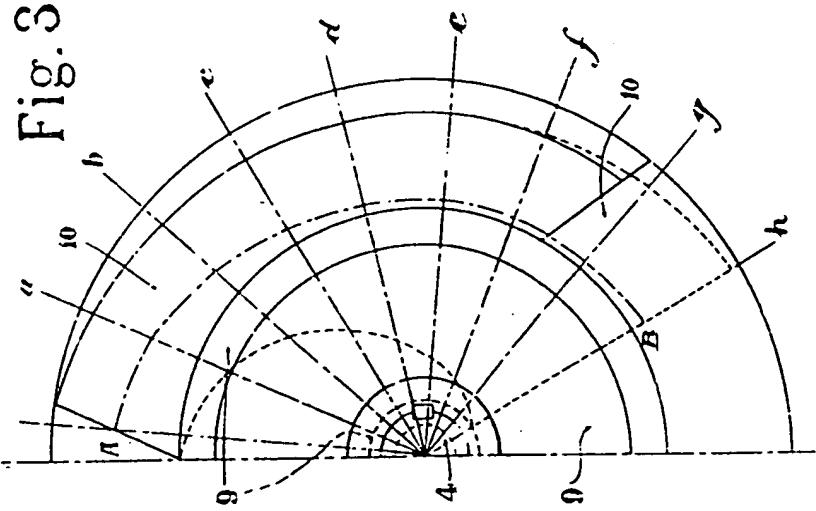


Fig. 3.



(This Drawing is a reproduction of the Original on a reduced scale)

Fig.4.

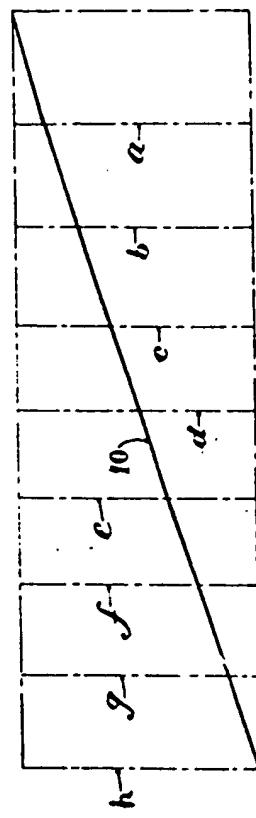


Fig.5.

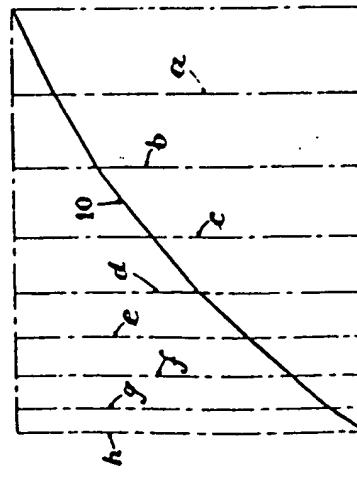


Fig.6.

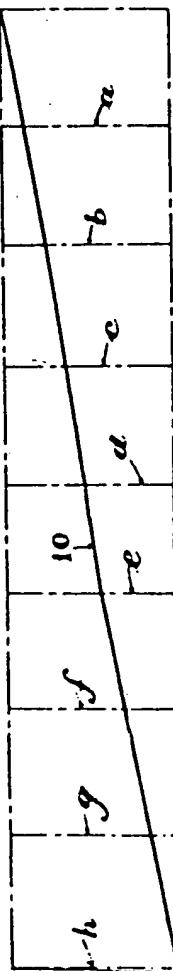


Fig.7.

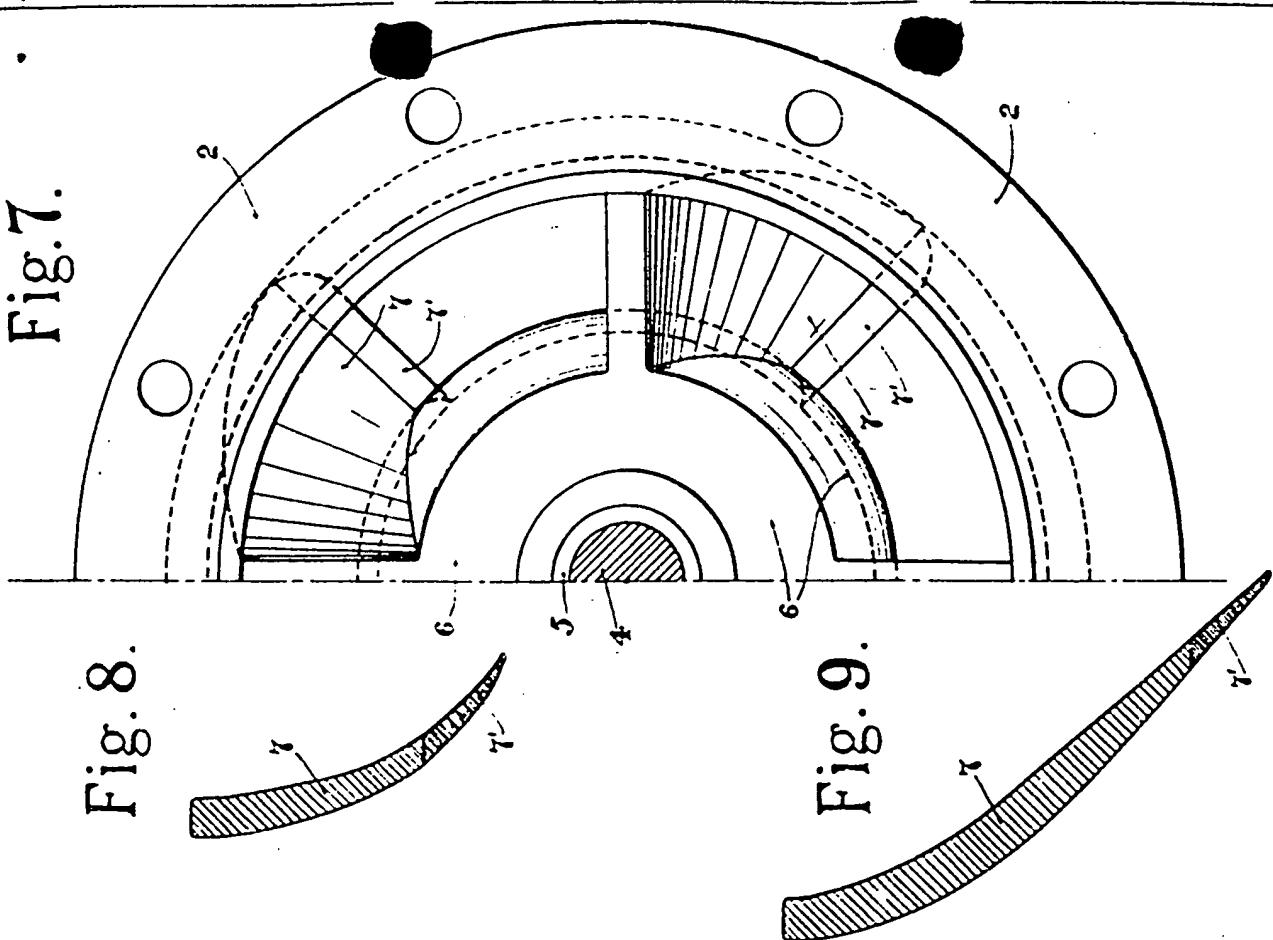


Fig.8.

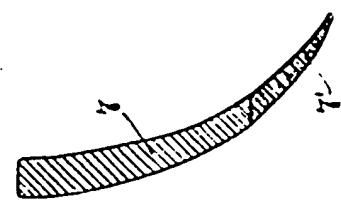


Fig.9.

